Assessment of Monitoring Methods and Benefits for Salmon Recovery Funding (SRF) Board Projects and Activities

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Prepared by

Taylor Associates, Inc.
Cascadia Consulting Group
Seattle, WA

R2 Resource Consultants, Inc.
Redmond, WA

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Our project success was largely dependent upon reaching our target number of project managers during our brief survey window from June 6-13, 2003. We would like especially to thank all the project managers who took the time to speak with interviewers and promptly returned phone calls so that they could be interviewed during this time.

Thanks to Debbie Knecht, Lewis County Public Works, for the photos of the 1999 Curtis Creek Barrier Removal project used on the cover of the report. These photos demonstrate an example of a before and after shot for a barrier removal project on Curtis Creek. This project provides an example of a recently completed in-stream passage project using Salmon Recovery Funding Board (SRFB) funds to remove a velocity barrier to fish passage.

Christy Shelton, Cascadia Consulting Group (CCG), developed the survey with technical assistance from Paul DeVries, R2 Resource Consultants, Inc., William Taylor, Taylor Associates, Inc. (TAI), and Sharon Walton, TAI. Laura Blackmore, Peter Erickson, Katie Kennedy, and Amity Lumper from CCG along with William Taylor, Heidi Wachter, and Sharon Walton from TAI conducted the interviews of project managers. Rob Oswald, CCG, and Peter Erickson completed database development. Peter Erickson performed the initial data reduction and analysis of survey responses with final analysis completed by Paul DeVries, Christy Shelton, William Taylor, and Sharon Walton.

The report was written and prepared by Sharon Walton, with contributions from William Taylor, Paul DeVries, and Christy Shelton. Bruce Crawford, Interagency for Outdoor Recreation/SRFB, provided preliminary review of the draft report results. Paul DeVries, Peter Erickson, Christy Shelton, William Taylor, and Heidi Wachter provided review of the draft report. Wendy John, WJTG, provided the cover design.

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EXECUTIVE SUMMARY

To date, approximately 260 projects and activities across the state have been completed using Salmon Recovery Funding Board (SRFB) funds. The recovery of salmonid habitat and ultimately salmonid populations across the state as a result of these projects and activities has not been quantified since the inception of the SRFB program in 1999. To better understand the effectiveness of these projects and quantify the benefits to salmonids and their associated habitat to date, the SRFB funded this pilot survey of completed projects and activities.

Taylor Associates Inc. along with Cascadia Consulting Group and R2 Resource Consultants (the Taylor Team) conducted this survey of completed projects funded by past SRFB grants. Specifically, the Taylor Team conducted a telephone survey of project managers associated with 143 completed projects that were funded by the SRFB between 1999 and 2001.

The goals of this telephone survey were twofold: (1) to evaluate general project success to date, and (2) to determine what monitoring methods are being used to evaluate project success and benefits. To accomplish these goals, project managers were asked a series of general questions about their project and a series of specific questions related to one of three main funding categories under which their project was grouped: acquisitions, assessments/studies, or habitat/capital projects. The habitat/capital group questions were further divided into six project types: in-stream diversions, in-stream habitat, in-stream passage, riparian habitat, upland habitat, and estuarine/marine nearshore.

Project manager responses were recorded in an online database and the results analyzed for general trends across all project types and for trends within the three project categories. Some of the key results include:

- Overall, 81 percent of all projects (n=143) reported meeting their original project objectives.[1]

[1] Please note that whenever reported results include multiple project types (such as for all projects, or for all habitat projects), the figures cited have been calculated in a manner that places more importance (or weight) on responses from project types that represent a larger portion of all completed projects in the population.

- For acquisition and habitat/capital projects, 80 percent of project managers (n=118) stated that monitoring was being conducted in association with the project.
- Only 55 percent of habitat/capital projects (and only 48 percent when acquisitions are included) included provisions for monitoring as part of their original project proposal. For individual project types, inclusion of provisions for monitoring ranged from 42 percent (in-stream diversions and riparian habitat) to 80 percent (upland habitat).
- Twenty-six percent of projects were reported to have submitted a monitoring plan to the IAC or SRFB.
- For the six habitat/capital project types, monitoring was most frequently based on either characterization and descriptive techniques (59 percent) or temporal (before-after) sampling strategies (59 percent).
- Fish/redd sampling (62 percent), riparian vegetative surveys (41 percent), and habitat characterization (27 percent) were cited as the top three methods used to evaluate projects.
- Fish species/density/age class structure (61 percent), riparian vegetative changes (38 percent), and channel morphology changes (21 percent) were cited as the top three metrics used to evaluate projects that included monitoring elements.
- Eighty-seven percent of project managers (n=80) stated that specific monitoring results were observed. These results were largely related to the successful installation of the project and included performance of screens, survival of plantings, and reduction in erosion as observable results.

Because of the limited scope of the survey, multiple project participants were not interviewed (except in a few instances) and the interviews were restricted primarily to discussion with the project manager or the primary project lead. The results presented here represent the self-reported findings largely of the project managers or key staff responsible for implementing the project.

Therefore, the survey results presented for this report represent largely a qualitative assessment of (1) how successful projects were in completing intended objectives and (2) the extent to which either qualitative or quantitative monitoring of the project occurred. The qualitative nature of these survey results was a limitation of project scope and schedule. Additionally, the subjective nature of interviewing for the opinions or perspectives of project managers regarding their own projects contributed to the qualitative nature of the survey results.

Survey results suggest that for most projects, some degree of implementation monitoring is occurring. Completion of this level was demonstrated by most projects as supported by project manager's responses to whether project objectives were met. Since most of these objective statements focused on implementing some action, implementation (compliance) monitoring was essentially performed for a high percentage of projects (81 percent of projects completed objectives as planned with only 2 percent citing objectives as incomplete).

Monitoring effectiveness of the project in meeting engineering and design criteria has also occurred for some projects. This level of monitoring was observed mostly in the case of in-stream passage, in-stream diversion, in-stream habitat, riparian, and upland projects.

Relatively few projects appeared to be associated with monitoring programs complex enough to begin to address the effectiveness of the project in meeting habitat-based outcomes. The project type most usually associated with effectiveness monitoring on this level came largely from the in-stream habitat project type where the greatest focus was on fish use and physical characterization of the habitat. Fish passage projects generally demonstrated the utilization of habitat upstream of the former barrier but generally could not quantify changes in fish usage related to the completion of the project.

No projects appeared to have collected effectiveness monitoring data (to date) to support assessment of local fish abundance or complete validation monitoring. Respondents cited a distribution of methods (fish/redds monitoring, habitat surveying, and so on) used for monitoring project effectiveness but these methods typically were not performed quantitatively and generally focused on qualitative documentation using methods like visual characterization.

Projects and activities that were included for the survey were generally completed in the last one to three years. Overall, very few of these completed projects or activities were (or are being) rigorously monitored to demonstrate an effect on fish survival or production. Since all projects are relatively new, any of the longer-term monitoring results that would answer larger questions about fish production have yet to be produced so no conclusive results can be stated. Given these findings and the accompanying observation that most monitoring has tended to rely on characterization and limited before-after comparisons rather than a structured monitoring plan, demonstrating that a project resulted in increased survival and fish production or if a project simply resulted in redistributing fish may not be possible in most cases.

For example, benefits of in-stream passage projects were typically corroborated using primarily visual characterizations to assess whether access to additional habitat was provided above the project site. That is, passage barriers were removed and fish were typically noted upstream when they had not been observed (or fewer numbers were observed) before. However, causal linkages were not determined between the visually observed results of increased fish usage upstream and increases in fish production in the system as a whole.

Similarly, survey results regarding monitoring of in-stream habitat projects suggest that the quality of habitat was generally improved and fish were now utilizing the project site whereas limited or no use of the site was documented prior to the project being completed. Whether the monitoring programs that were in place were designed to detect increases in production as opposed to fish simply redistributing themselves from one area to another was not apparent from survey results.

The preliminary results from this pilot assessment suggest that an experimental design to test positively the cause and effect between a specific project or set of projects and increased salmon production would require a significant amount of thought and subsequent financial and time commitments. Meeting such a rigorous experimental design may not be currently feasible on a project-by-project basis without significant funding increases.

Given the potential scale of monitoring required to evaluate the direct impact of projects on salmonid production, the SRFB could consider instead monitoring programs at the project-type level (passage, diversion, habitat, and so on). Such an effort could focus on determining: (1) what type of monitoring is appropriate to evaluate project effectiveness or success; (2) what specific questions should be addressed by each project type's monitoring plan; and (3) how monitoring results might affect SRFB's future decision-making processes.

1.0 INTRODUCTION

In 1999, the Salmon Recovery Funding Board (SRFB) was created by the Washington State Legislature to help fund salmon habitat projects and activities based on local priorities. These projects and activities have focused on land acquisitions, assessments and studies, and a variety of habitat projects including riparian and upland enhancements, barrier removals, channel enhancements, diversions, and estuarine/marine enhancements.

To date, approximately 260 projects and activities across the state have been completed using SRFB funds. The recovery of salmonid habitat and ultimately salmonid populations across the state remains unknown or not quantified at this time as a result of these projects and activities. To better understand the effectiveness of these projects and quantify the benefits to salmonids and their associated habitat, the SRFB funded this pilot assessment of completed projects and activities.

Taylor Associates Inc. along with Cascadia Consulting Group and R2 Resource Consultants (the Taylor Team) conducted this assessment of completed projects funded by past SRFB grants. This assessment consisted of a telephone survey (conducted by the Taylor Team) of project managers associated with 143 randomly selected projects that have been completed using SRFB funds between 1999 and 2001.

This report includes a synopsis of the survey, survey methodology, results, discussion, and recommendations. To the extent possible, the effectiveness of the projects and activities and associated benefits to salmon are quantified in the results section with related key questions addressed in the discussion. Additionally, the monitoring elements being used to evaluate the success of these projects and activities are described and related key elements are also addressed in the discussion.

2.0 SURVEY SYNOPSIS

For the assessment of completed projects, 160 projects were targeted for surveying with 143 surveys completed (55 percent of the total completed projects). From the total population of 260 projects, 143 completed surveys produces results with an estimated margin of error of ±5.5 percent at the 95 percent confidence level. To reduce coverage and non-response error and to obtain adequate representation of all project types, projects were selected using a stratified sampling approach, according to project type. For projects types with a small number of projects completed, all were included in the study while

project types with a large number of projects completed, some were randomly sampled. For example, surveys were attempted for all projects within a type for types with less than 25 projects. For types with more than 25 projects, 25 projects were randomly selected for interviewing. This sampling strategy was intended to improve the quality of the results. For project types in which not all projects were interviewed, the margins of error for the results are higher than for the overall survey population, due to the smaller populations and sample sizes.

The project types included acquisitions, assessments/studies, in-stream diversions, in-stream passage, in-stream habitat, riparian habitat, upland habitat, and estuarine/marine nearshore. The last six project types were identified collectively as the habitat/capital project category.

The survey was conducted over a six-day period beginning June 6 and ending on June 13. During these six days, an estimated 196 project managers were contacted or contacts attempted from a population of 260 possible completed projects. Of these contacts or contacts attempted, 143 projects and their project managers were successfully contacted and interviewed as summarized in Table 1 below. In some instances, a single project manager may have been interviewed for more than one selected project since multiple projects for certain areas of the state were managed by the same individual.

Table 1: Summary of Projects Surveyed by Type

Project Type	Pre-survey Project Totals[1]	Adjusted Totals[2]	Interview Target Totals	Actual Totals
Acquisition	21	21	21	21
Assessments and studies	77	76	25	25
In-stream diversions	20	21	20	19
In-stream passage	55	57	25	26
In-stream habitat	39	38	25	20
Riparian habitat	29	31	25	19
Upland habitat	16	13	16	10
Estuarine/marine nearshore	3	3	3	3
Grand Totals	260	260	160	143

1Totals here are based on the initial project categorization by the Taylor Team.

2Totals here are based on the final project categorization. After the surveys were completed, totals within some types were adjusted based on recategorization of the project based on information from the project manager.

Following the completion of the six-day survey period, each interviewer reviewed their data input and provided quality assurance/quality control for their respective survey results. This additional step was necessary prior to finalizing entry of the survey data into the survey database and beginning the result analysis. The primary tabulation and analysis of survey results occurred between June 17 and June 20, 2003, with some additional analysis continuing between June 23 and June 30, 2003.

3.0 SURVEY DESIGN

Because of the project's short timeline, survey design began at the kick-off meeting on May 27, 2003 and concluded on June 4, 2003. Both the Taylor Team and staff from the Interagency Committee for Outdoor Recreation (IAC)/SRFB participated in the initial discussion of the survey development at the May 27, 2003 meeting. Subsequent meetings were held by the Taylor Team to develop draft questions. Draft survey questions were developed using several sources of information as guidance. These sources included five main items: (1) the discussion at the May 27, 2003, project kick-off meeting; (2) the project scope agreement, work order number 0467-03-04-01-101008; (3) the Draft Monitoring and Evaluation Strategy for Habitat Restoration and Acquisition Projects; (4) the Washington Comprehensive Monitoring Strategy for Watershed Health and Salmon Recovery; and (5) the Fourth Round 2002 Salmon Application Forms. These sources of information served as background information for developing the draft survey questions.

The Taylor Team developed the majority of the draft survey questions over two working sessions on May 27, 2003 and June 2, 2003. The IAC/SRFB staff received the draft survey for review on June 3, 2003, and their comments were incorporated into the final survey on June 4, 2003. Appendix A includes a copy of the final survey instrument.

The goals of the survey questions were twofold: (1) to evaluate broadly overall project success to date and (2) to determine what monitoring methods are being used to evaluate projects. To accomplish these goals, the survey questions were divided among four main themes: (1) introduction and general background; (2) project overview; (3) monitoring of project results; and (4) overall project feedback.

The first and fourth themes were broad, and similar questions were asked of all project managers. Questions were more specific for the second and third themes, and reflected the three main project categories funded by SRFB – acquisition, planning and assessments, and habitat/capital projects. Project types were grouped into these three categories to identify whether differences in project success or levels of monitoring

differed between categories. The monitoring section also included questions specific to the six habitat/capital project types: in-stream passage, riparian habitat, in-stream diversion, in-stream habitat, upland habitat, and estuarine/marine nearshore.

In conjunction with the survey design, the Taylor Team also developed a Microsoft Access® database for real-time recording of responses while conducting the phone interviews. The database included a user-friendly data-entry form for the interviewers to use as a script during the phone surveys. The electronic form listed each survey question and included checkboxes for answers as well as text fields for qualitative responses or additional comments. The database was tailored to include questions for only the relevant project category and type, so that the survey was easily customized for each target project. The database also recorded all survey responses for subsequent analysis of results. The database design was tested throughout the week of June 2-6 to ensure that the questions were asked in the proper order and that only the relevant questions were asked of each project type.

4.0 SURVEY IMPLEMENTATION

On June 5, 2003, the Taylor Team held a survey training to prepare all the interviewers for conducting the phone surveys. The purpose of this training was to ensure that each staff member performing interviews would follow a standardized approach to survey questioning and data entry into the project database. This training also provided an opportunity for the interviewers to raise any questions about the survey content, goals, or expected results.

The survey of project managers for the selected projects was conducted between June 6 and June 13, 2003. Four attempts typically were made to contact each selected project manager over the course of the survey period. If successful contact of the selected project manager was not completed after four attempts or if it was determined that the project manager was not available during the survey period (for example, on vacation or in the field), the project manager for the next randomly selected project was contacted for the designated type, if additional projects were available. Half of the project types – acquisition, in-stream diversions, upland habitat, and estuarine/marine nearshore – had fewer than 25 projects completed and thus did not have back-up projects to contact if the initial contact attempts proved unsuccessful. For those project types, we made repeated contacts until we completed all the interviews that were possible within the survey timeframe.

5.0 DATA ANALYSIS

Upon completion of the phone interviews on June 13, 2003, the Taylor Team began analysis of the survey results. Queries were developed to summarize the survey results in the Access database. Quantitative results were then exported to a Microsoft Excel® workbook for further analysis and display of the results in bar graphs, pie charts, or summary tables. For qualitative answers and comment fields, answers were reviewed and summarized to the extent possible in the results section and Appendix B.

Because the sampling approach emphasized adequate coverage of project types with a limited number of completed projects, the number of surveys conducted for each project type was not necessarily representative of their proportion of the total number of projects. Some project types were overrepresented (acquisition, in-stream diversions, riparian habitat, upland habitat, and estuarine/marine nearshore), while others were underrepresented (assessments/studies, in-stream passage, in-stream habitat) with respect to their proportion of the total population.

Hence, survey results were weighted according to the project type's proportion of the total project population to present aggregated overall findings across multiple project types. For example, the assessments/studies category represented 76 of the 260 total completed projects (29 percent), while the project type accounted for 25 of the 143 completed surveys (17 percent). As a result, quantitative results for that project type were weighted to reflect its actual proportion of the total projects, so that the overall results would be representative of the expected results for the total 260 completed projects.

6.0 RESULTS

In this section, the key results from the survey are presented by topic area. These areas include general survey results, overall monitoring results, major category results, and overall project feedback. Additionally, the major category results are presented by the three major activity/project areas: acquisitions, assessments/studies, and habitat/capital projects. Unless otherwise noted, all survey results presented here are as reported by the respondent project managers and do not necessarily reflect the judgment of the Taylor Team.

Additionally, please note that whenever reported results include multiple project types (such as for all projects, or for all habitat projects), the figures cited have been calculated in a manner that places more importance (or weight) on responses from project types that

represent a larger portion of all completed projects in the population. Accordingly, the figures cited are intended to be representative of all completed SRFB-funded projects. As a result of this weighting methodology, any figures calculated from the actual project counts cited in this report will not necessarily correspond to the weighted percentages.

To the extent possible, the effectiveness of the projects and activities and associated benefits to salmon are quantified. Additionally, the monitoring results used to evaluate the success of these projects and activities are described.

For this project, the initial sample size of 160 projects was based on the attempt to survey 65 percent of the complete projects to obtain a statistically valid sample (±5 percent sampling error at the 95 percent confidence level).[2] Since the list of completed projects was slightly larger (260 projects verses 243 projects) and the actual number of completed project was lower (143 verses 160), the sampling error associated with the final sample size is slightly higher at ±5.5 percent.

To facilitate navigation through these results, each bulleted item includes a reference to the survey question number, which corresponds to the survey questions and results appendices (Appendix A and Appendix B, respectively). In this section, only the key results are presented for the each topic area. The entire written survey and the complete survey results can be found in Appendices A and B, respectively.

6.1 GENERAL SURVEY RESULTS/PROJECT OVERVIEW

For the general and project overview questions found in Parts A and B of the survey (Appendix A), the key survey results are presented. Complete question text and results can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided.

- Overall, 81 percent of all projects (n=143) reported meeting their original project objectives (Questions B-1 through B-3).
- Most projects reported meeting their target budget (86 percent) and timeline (77 percent). These rates were 90 percent for acquisition projects (Questions B-4 and B-5). Reasons cited for not meeting project budget included underestimated

[2] The target of 160 projects provided a small "cushion" to allow for unreachable project managers and other reasons for incomplete surveys. To reach the target sampling error of ±5 percent, 149 completed surveys were needed.

costs, permitting difficulties, scoping, and seller-related reasons. Reasons for not meeting schedule included permitting difficulties, seasonal window of activity, staffing difficulties, scoping, data availability, and seller related reasons.

- Steelhead trout (71 percent), chinook salmon (62 percent), and coho salmon (61 percent) were the top three targeted species reported by projects (Question A-5). Note: respondents could list multiple target species.
- In-kind contributions (35 percent) were the largest reported source of matching funds followed by local funds (29 percent) and federal funds (23 percent). Note: respondents could list more than one source of matching funds. See Question A-6.

6.2 MONITORING RESULTS

Responses regarding the monitoring of specific project results are presented here for the general questions found in Part C of the survey (Appendix A). These responses are divided into four topic areas: monitoring requirements; monitoring methods; baselines, duration, and costs; and monitoring observations.

6.2.1 Monitoring Requirements

General survey responses are presented for questions related to the conducting of monitoring elements and the development of monitoring plans associated with implementing projects. Complete question text and results can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided.

- For acquisition and habitat/capital projects, 80 percent of project managers (n=118) stated that monitoring was being conducted in association with the project (Question C-1).
- Only 55 percent of habitat/capital projects included provisions for monitoring (48 percent when acquisitions are included) as part of the project proposal. For individual project types, inclusion of provisions for monitoring ranged from 42 percent (in-stream diversions and riparian habitat) to 80 percent (upland habitat). See Question C-2.
- Forty-six percent of project managers stated that a monitoring plan was written with another 13 percent stating they did not know (Question C-3).
- Only 26 percent of project managers stated a monitoring plan had been submitted to the IAC or SRFB with another 14 percent stating they did not know (Question C-4).

6.2.2 Monitoring Methods

General survey responses are presented for questions related to monitoring methods used for evaluation of project effectiveness. Complete question text and results can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided.

- Of the projects where monitoring was being conducted (n=81), 69 percent stated that the results were available in some format (Question C-11).
- For the six habitat/capital project types, monitoring was most frequently based on either characterization and descriptive techniques (59 percent) or temporal (before-after) sampling strategies (59 percent). See Question C-12.
- Fish/redd sampling (62 percent), riparian vegetative surveys (41 percent), and habitat characterization (27 percent) were cited as the top three methods used to evaluate projects (Question C-13).
- Fish species/density/age class structure (61 percent), riparian vegetative changes (38 percent), and channel morphology changes (21 percent) were cited as the top three metrics used to evaluate projects (Question C-15).

6.2.3 Baselines, Duration, and Costs

General survey responses are presented for questions related to the establishment of a monitoring baseline, duration of monitoring elements, and costs associated with monitoring. Complete question text and results can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided.

- Sixty-seven percent of project managers (n=81) stated that a baseline had been determined for the project with baseline data most commonly reported (>75 percent) for in-stream habitat, in-stream passage, and riparian habitat projects (Question C-16).
- Information was not provided consistently in the survey responses regarding monitoring costs and related expenditures. Many project managers cited existing programs that funded some ongoing monitoring element. Others provided nominal dollar amounts associated with their respective monitoring programs.
- Sixty-nine projects provided monitoring frequency information (Question C-18). When project managers were asked how often data collection occurred, annual (30 percent) or semi-annually/quarterly (26 percent) were the most common responses.

- Responses (n=78) to monitoring program duration (Question C-19) varied from less than one year (1 percent) to indefinite or ongoing (44 percent). The range of four to five years received the second highest number of responses at 34 percent.

6.2.4 Monitoring Observations

General monitoring observations are presented for two questions specific to this topic. Complete question text and results can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided.

- Eighty-seven percent of project managers (n=80) stated that specific monitoring results were observed (Question C-20). These results were largely related to the successful installation of the project and included performance of screens, survival of plantings, and reduction in erosion.
- Project managers stated changes were noted in fish presence or density in 47 percent of the projects (n=86). See Question C-21.

6.3 RESULTS BY MAJOR FUNDING CATEGORY

Responses related to the monitoring of specific project results are presented here for the category specific questions found in Part C (Appendix A). Major funding categories of projects were defined as acquisitions, assessment/studies, and habitat/capital projects and corresponding questions were answered by respondents depending upon the category of their project. Projects were grouped into these three funding categories to identify whether differences in project success or levels of monitoring differed between categories. Some of the principal survey results by category are presented in this section.

6.3.1 Acquisitions

For acquisitions, results are presented for four main questions specific to this project category. Complete question text and results can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided.

- For acquisition projects, preservation was the most common stated project purpose (>90 percent) with at least 95 percent of acquisitions based on an assessment or study (Questions B-A1 and B-A2).
- Of the acquisitions that were based on assessments, 75 percent were based on assessments that included prioritized actions for the watershed. The assessment type was typically a habitat assessment or limiting factors analysis (Questions B-A3 and B-A4).

- Generally, the exact parcels being acquired were not specifically designated as prioritized actions for the watershed. However, the parcels acquired often did lie within larger areas that had been designated by the assessment as priorities. Furthermore, many project managers indicated that the parcel of land actually acquired was somewhat different from the originally intended parcel. In some cases the parcel grew in size (because of unanticipated events such as landowner donations), whereas in others an entirely different parcel was purchased (generally due to higher than expected land value).
- For acquisition projects, 71 percent had some type of project under way with 60 percent reporting riparian habitat as the most common type (Questions B-A5 and B-A6, Appendix B).

6.3.2 Assessment/Studies

For assessment/studies, results are presented for five main questions specific to this project category. Complete question text and results can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided.

- Fifty-six percent of assessments completed focused on specific sites or projects while the remaining 44 percent focused on the watershed as a whole (Question B-P1).
- For assessments/studies (n=25), increase knowledge base (72 percent) and identifying watershed/physical processes affecting restoration (60 percent) were identified as the top two goals associated with these projects (Question B-P2). Note: respondents were able to indicate multiple project goals.
- For 60 percent of assessments, a public report was completed. For another 8 percent, reports were completed but were not generally available to the public (Question B-P3).
- Fifty-six percent of assessments led to the identification of specific projects. These project included in-stream habitat, estuarine/marine nearshore, in-stream passage, and riparian habitat as the top four project types (Question B-P4 and B-P5).

6.3.3 Habitat/capital Projects

For habitat/capital projects, results are presented for five of the six project types. Estuarine/marine nearshore project results are not discussed here because of the small sample size (n=3). Complete question text and results can be found in Appendix A and

Appendix B, respectively. For each result stated, the corresponding question number is provided.

- For 96 habitat/capital projects, 74 percent were based on an assessment. Of those 96 projects, 39 led to some other project in the watershed (Questions B-H1, B-H5, and B-H6).
- For in-stream passage projects, 75 percent of projects conducted surveys of adults, redds, juveniles, and/or fry upstream of the barrier after implementation. Observation was the most common method (75 percent) with trapping, electrofishing, seining, or other method being cited much less frequently (Questions C-H2.1 and C-H2.2).
- Upstream/downstream comparisons were made for in-stream passage projects in only 30 percent of the projects with an additional 26 percent of project managers stating they did not know (Question C-H2.3).
- The primary purpose of riparian habitat projects was to provide in-stream shading (71 percent), followed by spawning/rearing habitat protection (59 percent), and bank stability (53 percent). Note: respondents were able to indicate more than one project purpose (Question C-H3.1).
- Willow stakes, container plants, and seedlings were the top three types of plant materials used for riparian planting projects (Question C-H3.2).
- Additional plantings were typically necessary for riparian plantings (56 percent), but temporary erosion control measures were not usually needed (only 12 percent). See Questions C-H3.4 and C-H3.5.
- For in-stream diversion projects where reduction in water was applicable (n=12), 67 percent stated that a reduction occurred. For projects where screens were applicable (n=11), 82 percent of respondents stated that the screens were 100 percent effective while the remaining 18 percent stated the screens were more than 75 percent effective (Questions C-H4.1 and CH4.2).
- For in-stream habitat projects, 94 percent of respondents stated habitat creation as the primary purpose of the project followed by 22 percent stating sediment transport modification (Note: respondents could state one or more purposes associated with their project). See Question C-H5.1.
- All ten of the upland habitat projects were completed for fine sediment abatement while four of the ten also stated stormwater control as a purpose of the project (Question C-H6.1).

6.4 OVERALL PROJECT FEEDBACK

Section D of the survey provided project managers an opportunity to give their overall impressions regarding project success, share lessons learned, and provide general feedback to the SRFB. Most questions asked in this section of the survey allowed for open-ended responses. Complete question text and responses can be found in Appendix A and Appendix B, respectively. For each result stated, the corresponding question number is provided. Only a brief summary of responses is presented here for this section of the report.

- Most survey respondents rated their projects as either very successful (74 percent) or moderately successful (24 percent). By individual project type, in-stream diversions (94 percent) and in-stream passage projects (96 percent) most frequently rated their project as very successful (note: 100 percent of estuarine/marine nearshore projects were rated as very successful but the sample size was only three). See Question D-1.
- When project managers were asked to characterize the quality of habitat that their project protected or restored, most respondents stated the habitat was either excellent (39 percent) or good (38 percent). No major differences in the percent breakouts were noted for acquisitions versus habitat/capital projects (Question D-2).
- Most project managers (88 percent) felt that the work product met their expectations (Question D-4).
- Project managers were asked to describe what elements of the project were particularly successful. Responses included partnerships, volunteers, landowners, basic design, modeling, diversion itself, barrier removal, creation of passage, fencing, plant survival, and planting techniques (Question D-5).
- When queried about the keys to project success, responses included cooperation, communication, strong partnerships, landowner willingness, good staff, good technical support, qualified contractors and consultants, good planning and design, and funding (Question D-6).
- Difficulties encountered by project managers were quite varied. Some of the repeating themes included insufficient funding, permitting, and getting sufficient plant materials. As far as lessons learned that might be applicable to future projects and specific comments to the SRFB, responses were again quite variable and are listed in Appendix B, Section D responses.

7.0 DISCUSSION OF KEY FINDINGS

In this section, several topics are discussed. These topics include impressions of the overall survey, effectiveness of the projects and activities, monitoring elements, and associated benefits to salmon from completion of these projects and activities.

7.1 OVERALL SURVEY IMPRESSIONS

The overall project knowledge exhibited by most project managers ranged from good to very good. The length of time since project completion was one of the major factors affecting the recall of project details by project managers. Additionally, interviewers noted that project managers sometimes suggested talking to someone else to get additional details regarding budget, cost, and monitoring related information. Consequently, significant unexplained variation in the survey results reflecting different levels of project knowledge may exist, and thus, answers such as "don't know" (or even "no") should not be interpreted strictly as a negative response (for example, limited monitoring may have been performed independently, but the project manager was not aware of it). Because of the limited scope of the survey, multiple project participants were not interviewed (except in a few instances) and the interviews were restricted primarily to discussion with the project manager or the primary project lead.

The survey results presented for this report therefore represent a qualitative assessment of (1) how successful projects were in completing intended objectives, and (2) the extent to which either qualitative or quantitative monitoring of the project occurred. The qualitative nature of these survey results was a limitation of project scope and schedule. The subjective nature of interviewing for the opinions or perspectives of project managers regarding their own projects also contributed to the qualitative nature of the survey results. To obtain more quantitative results, an independent assessment of a subset of projects is recommended. Even so, the results presented here provide a good preliminary impression regarding project success and levels of monitoring associated with a subset of completed projects.

7.2 FINDINGS PERTINENT TO EFFECTIVENESS MONITORING OF SRFB-FUNDED PROJECTS

Using a question and answer format, three main topics are discussed in this section. These topics include relationships between major project categories, monitoring methods, and benefits to salmon. For each topic area, key survey findings are discussed for each question.

7.2.1 Project Category Relationships and Relative Effectiveness

In this section, several questions related to the relationship between the three main project categories and the development of subsequent projects is explored. This exploration includes whether habitat/capital projects resulted from acquisitions and assessments and whether assessments lead to acquisitions.

Did acquisitions lead to projects?

Based on responses to questions BA-5, BA-6, and BA-8 (Appendix B), most projects related to acquisitions are still in the conceptual stage, so whether they will actually be implemented remains unclear. Most planned or actual projects identified were related to riparian revegetation and/or invasive vegetation control. Dike setbacks were the next highest project priority related to acquisitions. These types of projects (riparian revegetation/invasive control and dike setbacks) may be associated with more general and abstract (that is, less direct, measurable) benefits to salmon than most of the other habitat project types (estuarine/marine nearshore projects are also associated with difficulty in determining direct benefits to salmon production and survival). For example, riparian revegetation may require relatively large areas to have an influence (except possibly in very small channels) and the effects of dike setbacks on channel form and habitat are not readily quantifiable in terms of increasing salmonid production.

Did assessments lead to projects?

From the survey results (Questions BP-4, BP-5, BP-6, and BP-7, Appendix B), the extent to which specific projects were identified by assessments was difficult to determine. Responses to Questions BP-4 and BP-5, (if and how many projects were identified) were almost unanimously affirmative but respondents did not make the distinction regarding feasibility or ability to implement projects. Although the format of the survey was not designed to address this issue in detail, in many cases the definition of a project may have been interpreted more loosely to include general recommendations and categories of projects rather than a specific on-the-ground project.

In corroboration, responses to Question BP-6 indicated that feasibility was generally not addressed, implying that most assessments will likely require additional assessments before on-the-ground projects are realized. Responses regarding actual implementation (BP-7) were similarly less positive: eight of twenty-five assessments were reported as being associated with projects begun or completed.

Did projects originate from assessments?

A sizable fraction of projects that were reported to have resulted from an assessment did not appear to have been identified specifically by the assessment (Question BH-1, Appendix B). Rather, the project usually represented a means for addressing a more general problem identified in the assessment. The assessment did not determine specifically what the projected, specific benefits of the project itself would be on a specific stream channel or fish population. Many projects were identified as a result of local knowledge of habitat problems and opportunities to address them.

Specific examples where projects were cited as a result of an assessment are provided below:

- In-stream diversion – screen locations were identified in several assessments;
- In-stream habitat – projects were generally identified through assessments for reaches as opposed to sites, but the type of project appeared to present habitat opportunities that were in relatively short supply locally, thus actual project location may have been less important;
- In-stream passage – culvert locations were identified through surveys and WDFW prioritization methods; and
- Upland habitat – road segments that were decommissioned or upgraded were often identified specifically in an assessment.

Did assessments lead to acquisitions?

Based on responses to questions BA-2, BA-3, and BA-4 (Appendix B), nearly none of the acquisitions that were reported to have resulted from an assessment appeared to have been identified specifically by the assessment cited. Rather, the property or conservation easement acquired usually represented habitat of a type identified in an assessment as being (1) in short supply, (2) at risk of development or other loss, and/or (3) of high priority. The assessment did not determine what the projected, specific benefits of acquiring the property itself would be on a specific stream channel or fish population. Many of the properties were identified based on local knowledge of habitat problems and opportunities to address them.

7.2.2 Monitoring Methods

In this section, three questions related to the monitoring methods are explored. These questions focus on (1) the methods currently being used, (2) interpretation of methods

and metrics results by project type, and (3) the connections between survey results and the SRFB draft monitoring and evaluation strategy.

What monitoring methods are currently being used?

Based on the 143 surveys, project managers for 80 percent of projects responded yes when asked whether monitoring was occurring or had occurred as a part of the project. The extent of this monitoring was explored further through several additional questions. When asked about the monitoring approach or sampling design, the use of one or more monitoring approaches was cited for 95 percent of projects, while the approach was unknown for 5 percent of projects. The approaches used included temporal (before/after, 59 percent), spatial (control/treatment, 11 percent), characterization/description (59 percent), or other methods (5 percent). When asked about the establishment of baseline data for the project, 67 percent of projects stated that a baseline had been established (n=81).

Project managers were also asked specifically about the methods and metric used for their projects. For the 82 projects that cited a method or methods being used, 62 percent of projects cited fish/redd sampling as the primary method. This method was followed by riparian/vegetative surveys (41 percent), habitat characterization (27 percent), water quality (19 percent), and inspection/observations (17 percent). The remaining methods cited occurred for eight or fewer projects. Regarding metrics cited (n=82), fish species/density/age class structure received the highest response rate (61 percent), followed by riparian/vegetative changes (38 percent), and channel morphology changes (21 percent). Again, project managers could indicate one or more metrics in their responses.

When asked whether monitoring results had been reported, 69 percent of projects responded yes (n=81). Of those that reported results, only one-quarter stated that these results were reported to the IAC or SRFB.

Monitoring methodology was explored in more detail through each of the six project specific types (in-stream diversions, in-stream passage, in-stream habitat, riparian habitat, upland habitat, and estuarine/marine nearshore). Additional information is provided for three of these project specific types where more detailed monitoring related questions were asked. These types include in-stream passage, riparian, and in-stream habitat projects. Discussion of estuarine/marine nearshore projects is not included because of the

small sample size (n=3) while discussion of upland habitat and diversion projects is not included due to the limited monitoring scope associated with these project types.

For in-stream passage projects, 18 of 24 (75 percent) projects stated that surveys of adults, redds, juveniles, and/or fry occurred upstream after the barrier was removed. Methods used were largely observational (75 percent) with remaining methodologies including trapping, electrofishing, seining, or other being listed at rates much lower rates (between 4 and 17 percent). For the 18 projects monitored, 11 projects indicated changes upstream and 2 projects cited changes both upstream and downstream. The remaining 5 projects did not know whether changes had occurred.

Of the 24 in-stream passage projects, 21 projects cited the opening of spawning and rearing habitat upstream, while 3 projects did not know. Eleven of these projects stated that better habitat upstream of the diversion was now available relative to what was previously available downstream.

For riparian habitat projects, plant survival was the primary measure of project effectiveness. Plant survival ranged from greater than 40 percent (14 percent of projects) to greater than 90 percent survival (5 percent of projects). The majority of projects fell into the 75 percent (23 percent of projects) or the 80 to 90 percent (26 percent of projects) survival ranges. Additionally, 56 percent of projects required additional plantings.

For in-stream habitat projects, a series of more detailed questions about the project were asked if the project was either spawning gravel, erosion, adult habitat creation, or juvenile habitat related. Because of the small sample sizes for each subtopic, the results are not summarized here but can be found in Appendix B, questions C-H5.1 through C-H5.5.

Interpretation of Monitoring Methods and Metrics Findings by Project Type?

Acquisitions: In general, acquisitions are not associated with directed (that is, focused) monitoring. Only one acquisition project manager responded affirmatively regarding the completion of a detailed monitoring program. Perhaps lack of monitoring for this category may be a reflection of projects associated with the acquisition not being implemented yet. However, as a rule, even baseline monitoring was generally limited and intermittent for this project type. As a result, assessing whether the purchase achieved any benefits to salmon beyond those assumed to be associated with simple land preservation (the primary stated reason for acquisition by survey respondents) is not possible based on survey results.

Estuarine/marine nearshore projects: Limited sample size of funded projects precluded identifying trends for this project type. For the three projects completed to date, monitoring did not appear to reflect a rigid sampling design to test specific hypotheses regarding benefits to salmon such as increased habitat use. Rather, the monitoring approaches appeared to reflect a broad, descriptive method.

In-stream diversions: Monitoring was primarily effectiveness-related but locally focused on the screen location to verify whether the screening apparatus was working properly and if fish were in the vicinity. This monitoring was based on visual inspection/observation and fairly simple in design. Based on the responses for this project type, it remained unclear whether sampling was being conducted to determine if fish still made it into the screened area or the fate of fish returning to the stream.

In-stream habitat: This project type was generally associated with a greater extent of monitoring data collection effort than the other types. For these projects, the greatest focus was on fish use (presence/absence) and physical characterization of habitat using before/after comparisons with possibly a limited number of control/treatment comparisons as well. Thus, data from these projects cannot currently be used to determine if the project resulted in increased production and survival overall or simply redistributed fish from one area to another. Currently, project success must be inferred from synthesizing a variety of information rather than evaluating specific hypotheses for a specific site.

Fish passage: Passage projects were evaluated primarily with effectiveness monitoring (perhaps more so than other project types) and typically involved sampling for or observing fish presence or absence above barriers. Sampling involved mostly visual surveys. However, most projects did not make comparisons with downstream and relied primarily on making before/after comparisons using descriptive observations made above the project area. Currently, monitoring results from most projects probably cannot be used to determine if providing passage resulted in increased production in the stream as a whole or simply redistributed fish. Longer-term monitoring approaches may help in this respect, however, if the escapement upstream increases measurably over time, after factoring out other influences.

Riparian: Implementation monitoring associated with plant survival was a strong component of the overall monitoring approach for this project type. Effectiveness

monitoring protocols were not consistently used among projects but rather, a variety of descriptive metrics were used but without rigorous effort towards identifying effects to fish. A limited number of projects were associated with some form of before/after or control/treatment testing. Only a few studies looked at fish-based metrics to gauge project effectiveness, sampling primarily for fish presence or absence. Importantly, only four of the nineteen riparian projects surveyed specifically reported monitoring water temperature, even though shading was stated most frequently to be the primary project purpose.

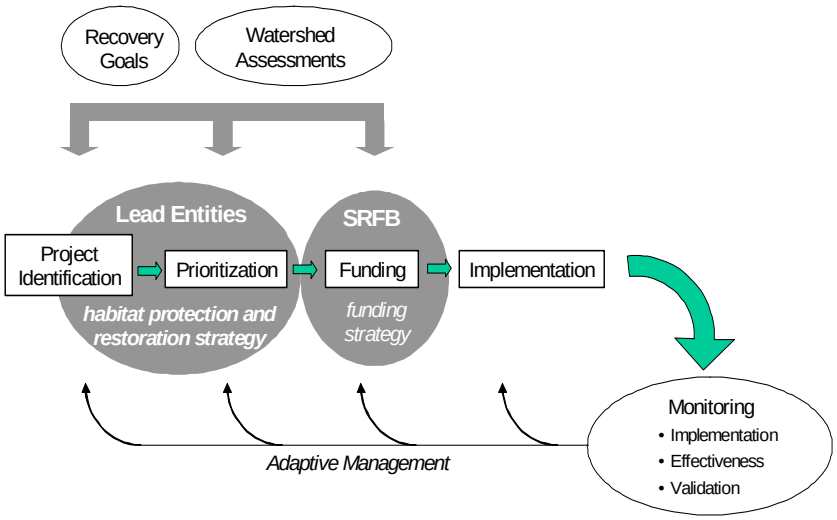
Upland habitat: Implementation monitoring was a strong component of overall monitoring approach for this project type. Effectiveness monitoring has consisted predominantly of indirect measurements including upslope erosion and in-stream embeddedness. Generally, no direct monitoring of effects on salmonid survival to emergence has occurred with exception of one reported effort to look at adult:fry ratios. Some projects looked at macroinvertebrate communities but it was not enquired how changes would be linked to project effectiveness. For several projects, effectiveness was defined in terms of changes in landowner practices. In general, project monitoring appeared to have a greater reliance on before/after comparisons than control/treatment comparisons.

What are the connections between survey results and proposed SRFB draft monitoring and evaluation strategy?

The SRFB's draft Monitoring and Evaluation Strategy (SRFB 2003) proposes several levels (Level 0-Level 4) of monitoring to evaluate project implementation success and guide adaptive management aspects and funding priorities for future projects. The levels of monitoring focus on three areas: implementation, effectiveness, and validation (Figure1).

Implementation monitoring (Level 0) determines whether an action has been implemented and requires a simple yes or no answer. Level 1 effectiveness monitoring focuses on whether a project has met its design and engineering criteria. Level 2 effectiveness monitoring focuses on whether a project meets habitat level functions while Level 3 effectiveness monitoring examines changes in fish abundance (production). Level 4 or validation monitoring operates on a watershed scale and looks to establish the cause and effect relationship between fish, habitat, water quality, water quantity, and related management actions (SRFB 2002).

Figure 1. SRFB Adaptive Management Model



Survey results suggest that for most projects, some degree of implementation monitoring (Level 0) is occurring. Completion of this level was demonstrated by most projects as supported by project manager's responses to whether project objectives were met. Since most of these objective statements focused on implementing some action, compliance or implementation monitoring was essentially performed for a high percentage of projects (81 percent of projects completed objectives as planned with only 2 percent citing objectives as incomplete).

Monitoring effectiveness of the project in meeting engineering and design criteria (Level 1) has also occurred for some projects. This level of monitoring was observed mostly in the case of in-stream passage, in-stream diversion, in-stream habitat, riparian, and upland projects.

Relatively few projects appeared to be associated with monitoring programs complex enough to begin to address the effectiveness of the project in meeting habitat-based outcomes (Level 2). In-stream habitat was the project type most commonly associated with Level 2 effectiveness monitoring. For these projects, the greatest focus was on fish use and physical characterization of the habitat. Fish passage projects generally

demonstrated the utilization of habitat upstream of the former barrier but generally could not presently quantify changes in fish populations related to the completion of the project.

No project individually appeared to have collected effectiveness monitoring data to support assessment of local fish abundance (Level 3) or complete validation monitoring (Level 4). Respondents cited a distribution of methods (fish/redds monitoring, habitat surveying, and so on) used for monitoring project effectiveness but these methods typically were not performed quantitatively and generally focused on qualitative documentation using methods like visual characterization.

7.2.3 Benefits to Salmonids

In this section, a single question regarding the benefits to salmon is explored. This question is addressed using the limited survey results for this topic.

What benefits were observed for salmonids and associated habitat?

The projects and activities included for the survey were generally completed in the last one to three years. Overall, very few projects of these completed projects or activities were rigorously monitored (or are in the process of being more rigorously monitored) to show an effect on fish survival or production. However, since the projects are relatively recent, longer-term monitoring results could potentially provide greater insights into effects on fish production. Presently, however, monitoring programs may not provide significant insights into the direct and indirect effects of funded projects.

For example, benefits of in-stream passage projects were typically corroborated using primarily visual, characterization based methods in terms of whether access to additional habitat was provided above the project site. That is, passage barriers were removed and fish were typically noted using the areas upstream when they had not been observed (or fewer numbers were observed) before. However, causal linkages were not determined between the visually observed results of increased fish usage upstream and increases in fish production in the system as a whole for this project type.

Similarly, the limited monitoring results for in-stream habitat projects suggest that the quality of habitat was generally improved and fish were now utilizing the project site when previously, limited or no use of the site was documented prior to the project being completed. Again, whether increased production was occurring or whether the fish were simply redistributing themselves from one area to another was not determined or was not intended to be determined through the monitoring program associated with the project.

8.0 RECOMMENDATIONS

This section contains recommendations to the SRFB for the three main project categories-acquisitions, assessments/studies, and habitat/capital projects. General recommendations are also provided for assessing project effectiveness in the future and for conducting subsequent evaluations (surveys) of project effectiveness.

8.1 FUTURE PROJECTS AND MONITORING

The survey results indicate the need for a more comprehensive monitoring effort than has occurred to date for SRFB projects and activities. Recommendations specific to the three main project categories are provided below based on survey results.

8.1.1 Acquisitions

The majority of acquisitions were based on a site preservation objective rather than a specific key habitat or refugia objectives. From the survey results, whether the objective of the acquisition was to preserve the site simply because there was an opportunity to purchase it independent of habitat was not clear. This result suggests that most acquisitions are based on incomplete to little information regarding the habitat value associated with the property. Therefore, the SRFB may have no real measure whether the purchase is making a difference individually or cumulatively across the state.

To ensure future acquisition projects are purchased for the more explicit purpose of protecting, restoring, or addressing salmon habitat, the SRFB may need to rely on better information than has been provided to date and consider whether applicants should include documentation of the specific benefits to salmonid habitat associated with any proposed acquisition projects.

For example, an independent review of projects associated with acquisitions could be conducted to identify or predict specific benefits to salmon by project type. The results of this review could be used to identify acquisition types that may be most directly beneficial to the long-term objectives of the SRFB.

8.1.2 Assessments/Studies

Assessments and studies need to be more focused on specific projects as end-points. The hierarchical strategy for prioritizing specific restoration activities recommended by Roni et. al. (2001) could be a possible framework, but it is beyond the scope of this document to determine how. For this category of SRFB projects, an independent technical review of

all assessment reports prepared to date is also recommended. This review would focus on more accurately determining the extent to which specific, on the ground projects were: (1) identified; (2) followed through on for funding, design, and permitting; and (3) implemented.

8.1.3 Habitat/Capital Projects

Based on the hierarchical strategy for prioritizing specific restoration activities (Roni et. al. 2001), projects that emphasize reconnection of isolated habitats are recommended for completion first. Related SRFB-funded projects that have been found through this survey to be most likely to be associated with effectiveness monitoring include in-stream passage and in-stream habitat. Survey results for fish passage projects generally support this strategy, confirming their apparent effectiveness and primary benefits to salmonids related to habitat access.

8.2 FUTURE ASSESSMENT OF PROJECT EFFECTIVENESS

Future monitoring of SRFB-funded projects will benefit from a more rigorous experimental design that would more directly assess cause and effect relationships. However, monitoring of the relationship between specific projects and increased salmon populations in a watershed would require an experimental design on such a time and spatial scale that the cost for the monitoring could approach the cost for a multitude of projects. In addition, uncontrolled sources of variation could well require extensive and intensive effort to detect a statistically significant change.

Given the potential scale of monitoring required to evaluate a cause and effect with regards to salmonid production, the SRFB could consider instead monitoring programs based on a project-specific level (passage, diversion, habitat, and so on). Specifically on the project level, determining (1) what type of monitoring is appropriate to evaluate specific elements of project effectiveness or success, (2) what type of information (what specific questions should be addressed) should a project specific monitoring plan and results provide, and (3) how that information might affect SRFB's future decision-making processes.

8.3 FUTURE SURVEYS

The responses to questions related to project success were generally positive and could be considered to be somewhat biased since those interviewed (primarily project managers) are also assumed to be the primary project proponents. Future survey work to evaluate project effectiveness should be constructed to ensure that the apparent potential for bias

could be minimized. This minimization may require using multiple survey tools or interviewing several project participants as well as completing an independent assessment of project effectiveness.

For example with more time, three to five technical committee members from each lead entity, in addition to project managers, could be interviewed to get a larger picture as well as multiple perspectives on the effectiveness of a single project or a group of projects for a region. Interviewing committee members and technical staff familiar with actual monitoring elements and outcomes would also be important. This approach would provide a range of responses that may be more likely to reflect critical objective responses than might come from a single project proponent.

The current survey results provide a quick, broad sweep of the projects. Future follow-up surveys and subsequent analysis could focus more intensively on particular areas of interest of the SRFB. Further surveys could also cover more of the completed projects, rather than just a sampling as was conducted for this project.

For future surveys, additional time and financial resources are recommended for preparing and reviewing the survey instrument, pre-testing the survey and the database, and conducting additional interviews with multiple project contacts. With additional time and related resources, further follow-up could be conducted to help verify any self-reported data. This follow-up might include field visits; additional interviews; and obtaining and reviewing project documentation, reports, and related materials. From this follow-up, different perspectives on the project would be gained which would be important for interpreting survey results and developing conclusions that are more definitive.

REFERENCES

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